

PLASTER OF PARIS TECHNIC

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FOREWORD

This combination of text and illustrations is a splendid contribution to the methods of using plaster of Paris in surgery. It is an art to use plaster of Paris skilfully, and this handbook explains the art. The illustrations are unusually fine.

I am particularly pleased to find that such a monograph is suitable for the instruction of both graduate and undergraduate medical students. This is a unique book and will be used extensively.

CHARLES L. SCUDDER, M.D.

PREFACE

There is an urgent need for a book on the use of plaster of Paris in surgery. Although plaster is used almost universally many doctors give very little thought to the technic of its application. A practical knowledge of this work is not only valuable in everyday practice, but is especially important in treatment of war injuries.

Although plaster of Paris has been used in surgery for a long time, relatively little has been written about it. Calot, in his book entitled "Indispensable Orthopaedics," published in 1921, called attention to the importance of good plaster technic. Schnek described the technic of applying unpadded casts for fractures in 1932, and later Böhler's writings in 1935 emphasized the value of unpadded casts combined with steel pins drilled through the bones for fixed traction on fractures.

Curriculums for medical students provide little or no instruction in this practical branch of surgery, although much time is devoted to the details of major operations. The beginner often must learn through his own resources, as there is no modern book on the subject, and textbooks on fractures and orthopaedic surgery devote only a short space to this topic. In many instances the surgeon himself does not apply the plaster to his cases, but assigns this part of the treatment to the interne; the latter, who cannot learn without instruction, does the best he can, but in many instances this is far from satisfactory. Finally, there appears to be a popular idea that the application of plaster amounts to just so much labor, and that it requires time which could be spent otherwise to greater advantage. All of these facts would appear to explain the meagre knowledge of the subject possessed by the medical profession.

Descriptions of plaster of Paris for immobilization are found in ancient history. Various forms of rigid bandages for immobilization were used as early as 1600 B.C. by the Egyptians, who applied gums and waxes to stiffen their surgical dressings in a

manner similar to their method of embalming. More than a thousand years later Hippocrates described a similar method of treating broken limbs. The use of plaster of Paris for fractures first was reported by Eton, who described a method in which solid gypsum was used by the natives of Basra; this material was poured over limbs in liquid form. In 1852, Matthysen, a medical officer in the Dutch army, described the use of gypsum bandages for treating the wounded in battle.

Wooden splints, metal splints, and the cellulose-compound preparations recently described have certain advantages, but for general purposes nothing ever has been found to equal plaster of Paris. Although plaster bandages are used almost exclusively in the United States, pattern plaster is preferred by some surgeons abroad; in the latter form, as the term implies, the plaster is laid over various parts of the body in shapes already cut out. The recent development of skeletal fixation splints will prove valuable, although plaster of Paris remains the most satisfactory form of immobilization in orthopaedic and fracture surgery.

Orthopaedic technic and the reduction of fractures have been intentionally avoided in this book, as its scope includes only the application of plaster of Paris. To learn plaster technic the reader not only is advised to follow the instructions carefully, but he also should practice extensively on actual cases.

EDWIN O. GECKELER.

Philadelphia, Pa., July, 1944.

INTRODUCTION

For a long time plaster of Paris has been indispensable to orthopaedic surgery; without it the results of many cases would be complete failures. Calot considered plaster technic so important that he wrote, "Show me your plaster . . . and I will tell you what kind of orthopaedist you are."

Until recently wooden and metal splints were considered satisfactory for the immobilization of many fractures, but now plaster is considered as necessary in traumatic surgery as it always has been in the realm of orthopaedics. Only plaster of Paris provides firm, adequate protection and immobilization. Plaster is strong, and yet light; unlike wooden or metal splints, which become loose and need to be rebandaged frequently, it requires little or no attention and can be worn for weeks if properly applied. Plaster is entirely adaptable to whatever position is necessary for immobilizing any part of the trunk and limbs, being fitted or molded to shape while it hardens; on account of this feature it is ideal for the correction of congenital deformities. It is essential in treatment of acute and chronic joint diseases, and for immobilization after operations on bones. Many thousands of compound fractures were immobilized with plaster of Paris during the recent Spanish Civil War with remarkable results. The "closed plaster" method, popularized by Orr and Trueta, has saved countless lives and limbs in the present World War, and permits early evacuation of the wounded with a minimum of hospitalization. The latest development in the use of plaster has been for severe burns. By the early application of plaster of Paris to burned limbs contractures and deformities can be prevented in many cases, and minimized in more severe cases. On the modern battlefield plaster of Paris can be applied in mobile units, without the necessity of hospitalization. Good plaster bandages can be made by almost anyone, or several brands of ready-made bandages may be purchased; they are not expensive, and can be carried easily.

There are few objectionable features to plaster of Paris. The

immobilization of normal joints in a cast is one disadvantage, although much of the atrophy and weakness in a limb can be prevented by systematic exercises and protected use while the plaster is worn; another disadvantage is that it is impossible to see the condition of the skin or to inspect a wound under a closed cast. Pressure sores may occur, although these can be prevented. However, the many advantages possessed by this form of immobilization far outweigh its disadvantages.

Plaster casts and splints are ruined when they become wet, and for this reason may be unsatisfactory in the tropics. As a substitute, rigid water-proof immobilization can be obtained by the application of "Castex" bandages or other forms of the new plastics, which are thin and light in weight, and permit X-ray examinations.

CONTENTS

INTRODUCTION.....	ix
CHAPTER I	
FORMS OF PLASTER OF PARIS USED IN SURGERY.....	1
Plaster of Paris. Hand made plaster bandages. Commercially made plaster bandages. Plaster reinforcement strips or splints. Pattern plaster.	
CHAPTER II	
GENERAL TECHNIC (BANDAGE METHOD).....	11
Accessories. Care of the hands. Padding. Wetting the plaster bandages. The "critical point." Drying of plaster.	
CHAPTER III	
APPLICATION OF PLASTER OF PARIS (BANDAGE METHOD).....	27
Plaster splints. Plaster cases or padded casts. Reinforcement of casts. Unpadded or "skin-tight" plaster casts. "Wedge casts." Plaster molds.	
CHAPTER IV	
ERRORS AND DIFFICULTIES.....	52
Unsatisfactory materials. Unsatisfactory soaking of plaster bandages. Plaster sets too rapidly. Cast buckles or cracks. Cast sets too slowly. Trouble from tight casts.	
CHAPTER V	
TECHNIC OF PATTERN PLASTER.....	57
CHAPTER VI	
SPINE.....	72
Cervical spine. Dorsal spine. Lumbar spine.	
CHAPTER VII	
SHOULDER AND UPPER LIMB.....	88
Arm (<i>humerus</i>). Posterior or anterior splint. Sugar-tong splint. Hanging cast. Shoulder spica. Elbow. Anterior and posterior splint. Circular cast. Shoulder spica. Forearm. Anterior splint. Sugar-tong splint. Circular cast. Wrist. Anterior splint. Sugar-tong splint. Circular cast. Hand. Anterior splint. Spica of the hand.	

CHAPTER VIII

PELVIS AND LOWER LIMB.....	120
Short double spica. <i>Hip</i> . Short single hip spica. Long single hip spica. Double hip spica. <i>Thigh</i> . Hip spica. <i>Knee</i> . Posterior or ham splint. "Non-slip" cast. Complete padded cast. Hip spica. <i>Leg</i> . Posterior splint. Unpadded cast. Antero-posterior splint. Padded cast. <i>Ankle</i> . Posterior splint. Padded cast. Unpadded cast. Walking cast. <i>Foot</i> . "Moccasin" splint. Padded cast. Walking cast. Spica of the toe.	

CHAPTER IX

PLASTER OF PARIS IN WAR SURGERY.....	182
Application of plaster for transportation. Plaster combined with skeletal traction. Danger with plaster casts. <i>Application of plaster for individual fractures</i> . Tobruk plaster. Plaster Velpeau dressing. <i>Application of plaster for individual joint injuries</i> .	

CHAPTER X

PLASTER IN WAR SURGERY—COMPOUND FRACTURES AND OSTEOMYELITIS..	191
Difficulties with closed plaster treatment. Change of plaster.	

CHAPTER XI

PLASTER FOR INJURY AND INFLAMMATION OF SOFT TISSUES. THE USE OF PLASTER OF PARIS FOR BURNS.....	195
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CHAPTER XII

FOLLOW-UP CARE.....	200
Protection of plaster. Trimming the plaster. Circulation. Pressure ulceration. Making windows. Reinforcement of casts. Correction of angulation. Changes in joint angle. X-ray examination. Nursing. Removal of plaster casts. Application of new plaster. Instructions to patients wearing plaster.	
REFERENCES.....	217

CHAPTER I

FORMS OF PLASTER OF PARIS USED IN SURGERY

Plaster of Paris. Plaster of Paris is a refined form of natural calcium sulphate or gypsum which has been pulverized to break up the crystals, and then subjected to intense heat. This process drives off the water content and impurities. When this anhydrous powder is added to water re-crystallization or “setting” occurs. After plaster of Paris has hardened its shape cannot be changed. The microscopic picture of this transformation has been described by Luck. When the powder comes into contact with water the chemical substance reverts to its original crystalline form. The crystals are formed rapidly, and join in a regular compact pattern. To a large extent the compact arrangement of these crystals provides the strength of the plaster after it hardens. This interlocking of the crystals will not take place satisfactorily if the mixture of plaster of Paris and water has been disturbed before it has hardened completely. It is important to use the best grade of plaster of Paris powder, such as may be obtained from Samuel H. French and Company of Philadelphia. The “Regular Dental” grade of plaster hardens or “sets” within five minutes after it has been moistened, and is the most satisfactory form for surgical purposes. Although this grade of plaster hardens in five minutes it may not dry until one or two days afterwards. For most purposes faster-setting plaster should be avoided as it becomes stiff and crumbles before it can be applied properly. The setting time of plaster of Paris can be accelerated by adding sodium chloride to the water, or it can be retarded by the addition of sugar; however, in most instances such accelerators or retarding agents should be avoided, as they make the plaster brittle. The setting time is regulated best by varying the temperature of the water; thus, if the surgeon wants the five-minute plaster to set faster warm water should be used, and if he wants it to set more slowly cool water is necessary. It has been found that at 40 de-

degrees Fahrenheit the setting time of plaster was three times longer than at 125 degrees Fahrenheit. Plaster should be stored in a dry place; if kept in a barrel it must not be kept in a damp location or near a window, as it readily absorbs moisture and thus is ruined. Small quantities of plaster are sold in steel drums fitted with tight gaskets, and with this protection the powder will not deteriorate in damp climates and when kept for a long time.

Handmade plaster bandages. In the United States plaster of Paris almost always is applied in the form of bandages, and the most satisfactory plaster bandages are made by hand. To make these the Regular Dental grade of plaster of Paris powder, which should be free of grit, is rubbed into pieces of crinoline. The crinoline, which contains starch sizing, is made especially for this purpose, and may be obtained from various surgical houses in the form of bolts. The most satisfactory mesh for holding the plaster powder has from 28 to 32 threads to the inch. The nurse should mark the width of the bandages on the end of the bolt, the most useful widths being three, four and six inches; the usual length of the bandages is three yards, four yards, and five yards, respectively. Crinoline must be torn into strips and never cut. To prevent unravelling and constriction as the bandages are applied later, two threads should be separated with a pin and removed from both edges of these strips. Crinoline already cut in standard widths, and with the edges pinked or serrated to prevent the side threads from unravelling, can be purchased from The Kendall Company, Walpole, Mass. Inferior forms of plaster of Paris vary in their setting time and usually are lumpy; if lumpy the plaster must be sieved before it is used. To make a plaster bandage the powder is rubbed thoroughly into the mesh of a piece of crinoline, the first portion of the bandage being rolled so loosely as to leave a half-inch space in the center; if this detail is neglected the inside part will not become wet when the bandage is immersed in water. If the powder is not rubbed into the crinoline uniformly there will be dry spots in the bandage as it is applied. As the bandage is rolled no more powder should be added than is held by the mesh, and it must not be rolled tightly; if either of these mistakes is made the bandage will remain dry after it has been placed in

water, and as a result the plaster will crumble when it is applied. However, if the bandage is rolled too loosely it is difficult to prevent it from "telescoping" when it is removed from the water. Upon completion of a plaster bandage it either may be wrapped in waxed paper or in a paper napkin, or a rubber band can be used to prevent it from unrolling. Plaster bandages must be handled carefully, as the powder is easily shaken out of the mesh, and they should be laid lengthwise in a metal box. It is important to keep them in a dry location, as dampness ruins them; however, they must not be placed near a radiator or hot-water pipes, as excessive heat causes the plaster to set too fast. A liberal supply of plaster bandages of various widths should be available in hospitals at all times for the treatment of fractures, as they cannot be made on short notice.

Commercially made plaster bandages are not as satisfactory for general use as those made by hand; the pieces of corrugated paper which most of them contain are clumsy, as these must be removed while the bandages are unrolled. However, machine-made plaster bandages can be carried more satisfactorily than those which are made by hand, as the plaster in them does not shake out. The particular advantage of the "Specialist" hard-coated plaster bandages manufactured by Johnson and Johnson of New Brunswick, N. J. is that the plaster adheres to the crinoline and thus cannot fall out in handling, and they do not contain corrugated paper. These plaster bandages are more satisfactory for occasional use than those made by hand, and thus are practical for small hospitals and for office work.

Plaster reinforcement strips or splints are used to strengthen plaster casts, or may be applied as simple splints. These are made by folding together 10 to 20 lengths of crinoline strips as plaster of Paris powder is rubbed into the mesh, and then are kept in boxes until used. Such reinforcement strips save much time and trouble, and a supply of them should be available in the doctor's office and in the hospital. The "Specialist" splints manufactured by Johnson and Johnson are convenient for light use and are easy to carry, as the plaster in them adheres to the crinoline and does not shake out.

Pattern plaster. This kind of plaster, although not commonly used in the United States, is popular in some parts of Great Britain and Europe. It is also known as cream-fabric plaster. Thick flannelette with a loose mesh is cut to fit the part which is to be immobilized, or instead several thicknesses of the regular crinoline which is sold for making plaster bandages may be used. If crinoline or flannelette is not available gauze or other open mesh goods will answer the purpose. The size and shape of the cast is determined by cutting a paper pattern of the affected limb. The crinoline should be cut ten per cent larger than the paper pattern, on account of the shrinkage which occurs when it is immersed in the plaster "cream." After sprinkling enough plaster of Paris powder into a basin containing the required amount of cool water and stirring until the mixture becomes like thin cream, the piece of flannelette or crinoline is immersed in this plaster cream and then the slab is applied immediately to the affected part. With the pattern plaster technic it is not necessary to have plaster bandages made in advance, as only the goods and loose plaster of Paris powder are required. The simplicity of this method and the rapidity of its application are decided advantages in the management of war fractures, and have been explained in detail by Trueta. As with the other forms of unpadded or "skin-tight" plaster the circulation should be watched, and if swelling occurs the plaster should be cut and spread immediately. For the technic of pattern plaster see Chapter V.

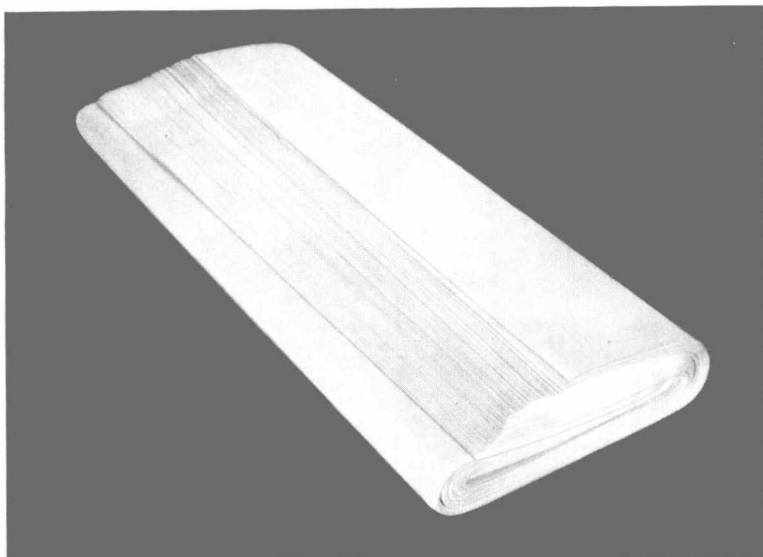


FIG. 1. Bolt of Uncut Crinoline. This material is manufactured especially for plaster of Paris bandages. It must be torn into various lengths and widths.

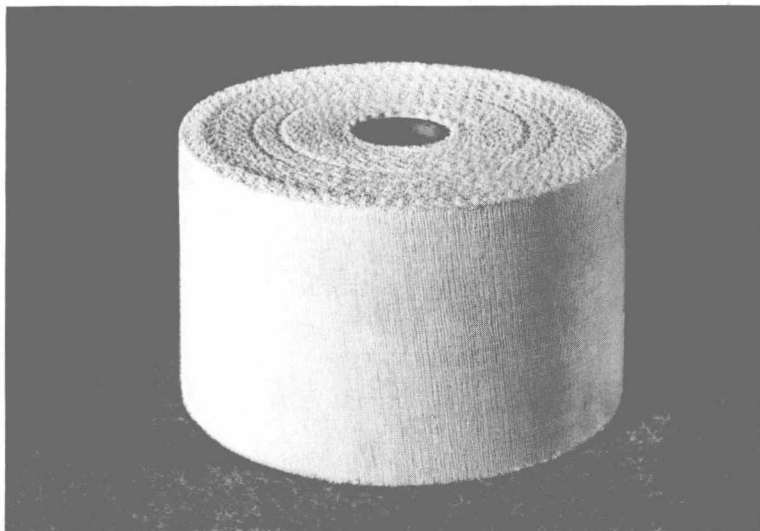


FIG. 2. Roll of Pinked Crinoline. The serrated edges of this crinoline prevent unravelling as the plaster bandages made of it are applied.

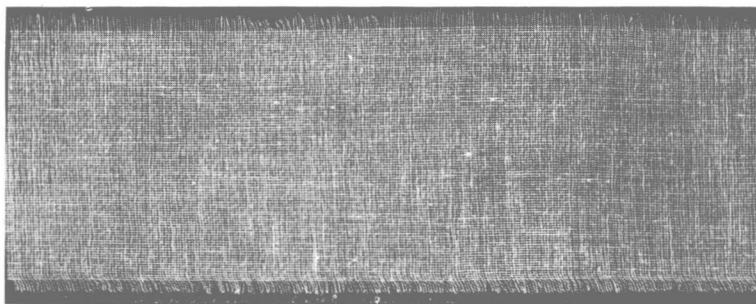


FIG. 3. Sample of Crinoline. This piece of crinoline has been torn from a bolt. Two or three threads must be pulled from each side of the strip before it is rolled into a bandage, to prevent unravelling.

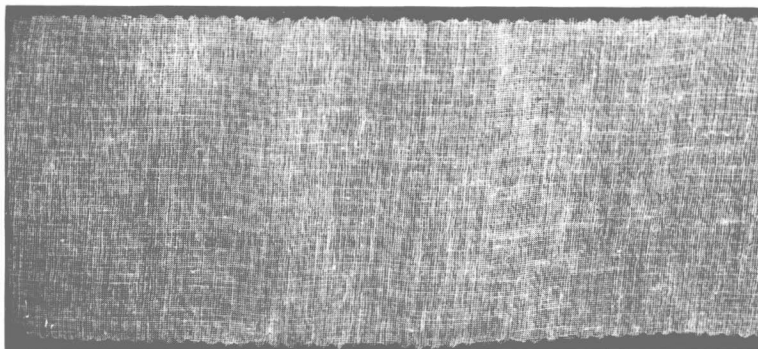


FIG. 4. Sample of Crinoline. This material is ready for making plaster bandages. It can be purchased in various widths, with pinked edges.



FIG. 5. Making a Plaster of Paris Bandage. The meshes of the crinoline should be filled completely with plaster of Paris powder, the loose powder being rubbed in by advancing strokes as the bandage is rolled. There should be no excess of powder in a plaster bandage.

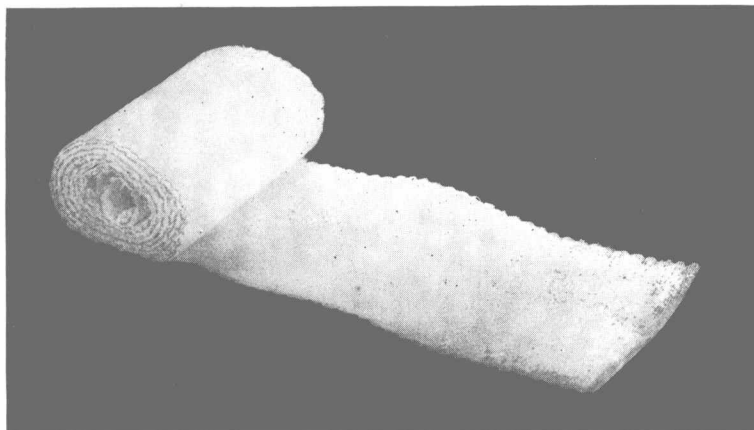


FIG. 6. A Well Made Plaster Bandage. The meshes are filled uniformly with plaster, and the bandage is rolled loosely enough to absorb water readily when used. The space in the center likewise facilitates soaking.

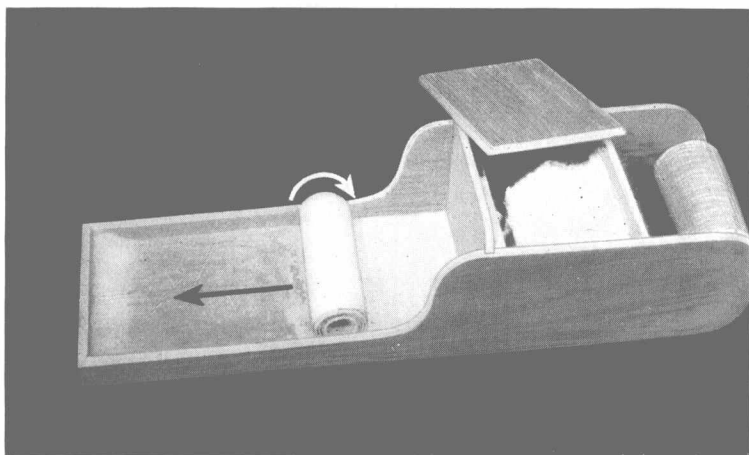


FIG. 7. A Simple Apparatus for Making Plaster Bandages. This wooden box is inexpensive. The crinoline is drawn through a slot in the bottom of the box, which is filled with plaster of Paris, thus filling the meshes rapidly and evenly. (Courtesy of Dr. Rubin Lewis.)